ENVIRO-TEC® BY JOHNSON CONTROLS	INDOOR AIR HANDLING UNIT	
INSTALLATION, OPERATION & MAINTENANCE	ET102.19-NOM1 (209)	Form ET102.19-NOM1 (809)

MODEL MQL SERIES B

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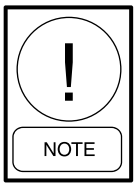
SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to areas of potential hazard:

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

CAUTION identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution. Usually an instruction will be given, together with a brief explanation.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



NOTE is used to highlight additional information which may be helpful to you.

SAFETY CONSIDERATIONS

The equipment covered by this manual is designed for safe and reliable operation when installed and operated within its design specification limits. To avoid personal injury or damage to equipment or property while installing or operating this equipment, it is essential that qualified, experienced personnel perform these functions using good judgment and safe practices. *See the following cautionary statements.*

ELECTRICAL SHOCK HAZARDS. All power must be disconnected prior to installation and serving this equipment. More than one source of power may be present. Disconnect all power sources to avoid electrocution or shock injuries.

MOVING PARTS HAZARDS. Motor and Blower must be disconnected prior to opening access panels. Motors can start automatically, disconnect all power and control circuits prior to servicing to avoid serious crushing or dismemberment injuries.

HOT PARTS HAZARDS. Electric Resistance heating elements must be disconnected prior to servicing. Electric Heaters may start automatically, disconnect all power and control circuits prior to servicing to avoid burns.

Check that the unit assembly and component weights can be safely supported by rigging and lifting equipment.

All assemblies must be adequately secured during lifting and rigging by temporary supports and restraints until equipment is permanently fastened and set in its final location.

All unit temporary and permanent supports must be capable of safely supporting the equipment's weight and any additional live or dead loads that may be encountered. All supports must be designed to meet applicable local codes and ordinances.

All fastening devices must be designed to mechanically lock the assembly in place without the capability of loosening or breaking away due to system operation and vibration, vibration, impact or seismic events.

Secure all dampers when servicing damper, actuator or linkages. Dampers may activate automatically, disconnect control circuits or pneumatic control systems to avoid injury.

Protect adjacent flammable materials when brazing, Use flame and heat protection barriers where needed. Have fire extinguisher available and ready for immediate use.

INSPECTION

Upon receipt of equipment, carefully check all items against the bill of lading to ensure that all equipment has been received. Note any discrepancy on the bill of lading before signing.

Inspect all equipment for any signs of damage caused during transit. Note any visual damage on the bill of lading before signing. Immediately report all visual and concealed damage to the carrier and file a claim.

INTRODUCTION

General

In order to ensure long and trouble free life, the equipment should have proper care and maintenance. Enough space should be left around the unit for service and repair, *see Installation Section for recommendations.*

Equipment, as shipped, is factory assembled as far as job specifications and shipping limitations allow. Where field assembly is required, bolts, nuts, screws and gasketing material are provided with each module. Modules bolt together from the inside of the upstream module.

Unit Identification

To ensure the assembled MQL modules are in the proper sequence, each module has an identifying code and an airflow direction label. The proper assembly sequence is listed on the supply fan nametag. The first listed module is the first section in the direction of airflow.

RIGGING AND HANDLING

The MQL air handler can ship as separate modules, fully assembled, or in separately assembled sections depending on the unit size and application. The equipment must be rigged as it was shipped from the factory. Do not remove shipping skid or protective cover until equipment is ready for final placement, as damage to equipment can result. Do not remove protective caps from piping connections until ready to connect piping.

Units with base rails can be rigged by means of lifting holes on the end of base rail *(see Fig. 1).*

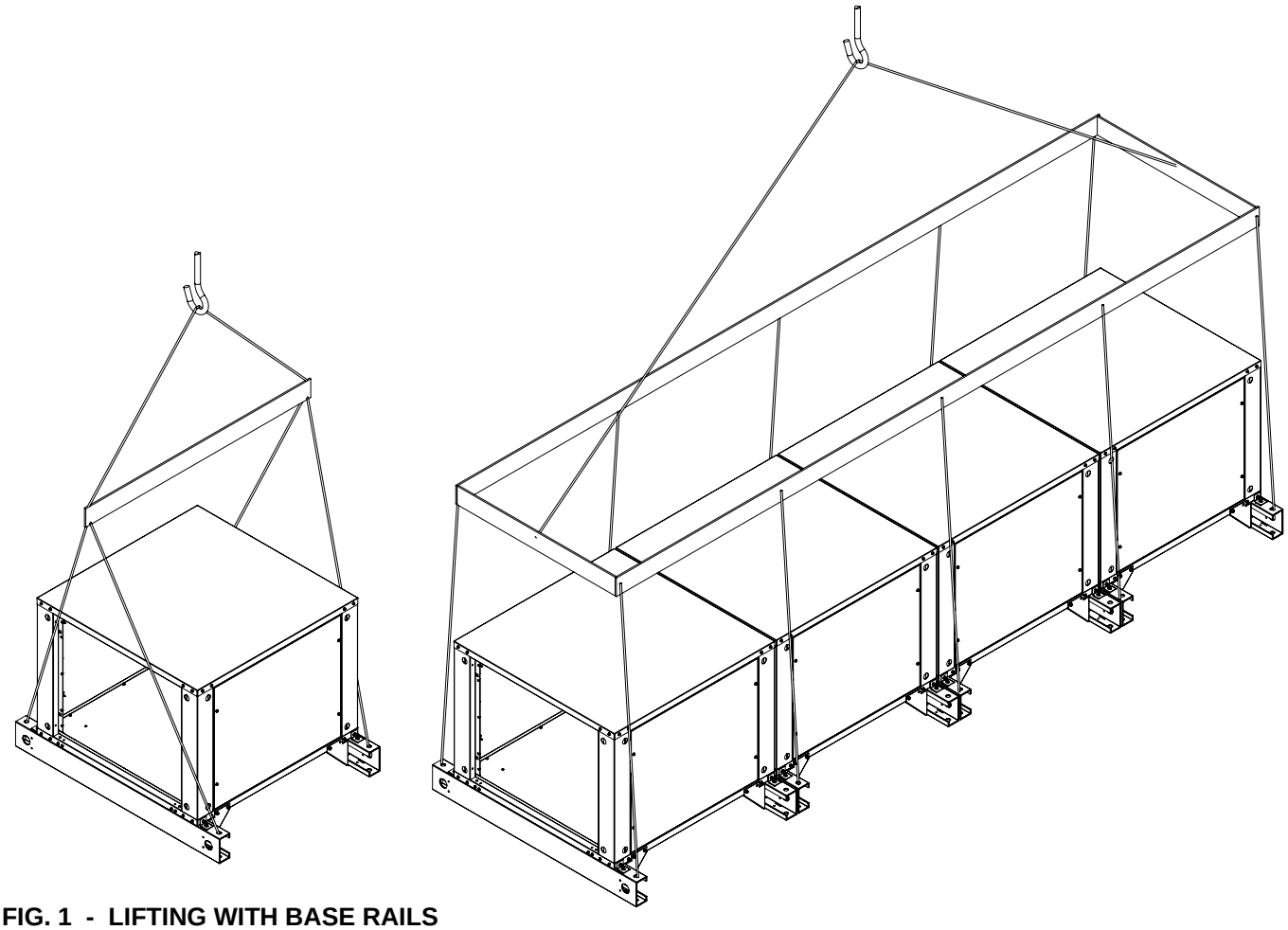


FIG. 1 - LIFTING WITH BASE RAILS

Units without base rails must be lifted with slings. Place slings at ends and joints of modules to prevent damage to equipment *(see Fig. 2).*

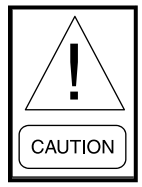
Spreader bars should be used to prevent damage to equipment. Avoid twisting or uneven lifting of equipment. Do not lift equipment by coil connection or headers. *See submittal drawings.*

If transporting units with forklift, forks must extend the full width of unit to prevent damage to bottom of unit.

Always take special care when handling the blower module. All fans are dynamically balanced. Rough handling may cause bearing misalignment and/or shaft damage.

STORAGE

To transfer equipment from truck to storage site, *refer to rigging details in figure and section on equipment rigging for proper handling.*



If a forklift is used, lift only from heavy end of skid.

1. Do not stack unit modules or accessories during storage. Stacking can cause damage or deformation.
2. If equipment is to be stored for more than two weeks prior to installation, observe the following precautions:
   a. Choose a dry storage site that is reasonably level and sturdy to prevent undue stress or permanent damage to the equipment structure or components. Do not store equipment on vibrating surface. Damage to stationary bearings can occur. Set equipment off ground if in moisture prone areas.
   b. Remove all shipped loose parts from job site to minimize theft. Tag and store parts in a safe place until needed.

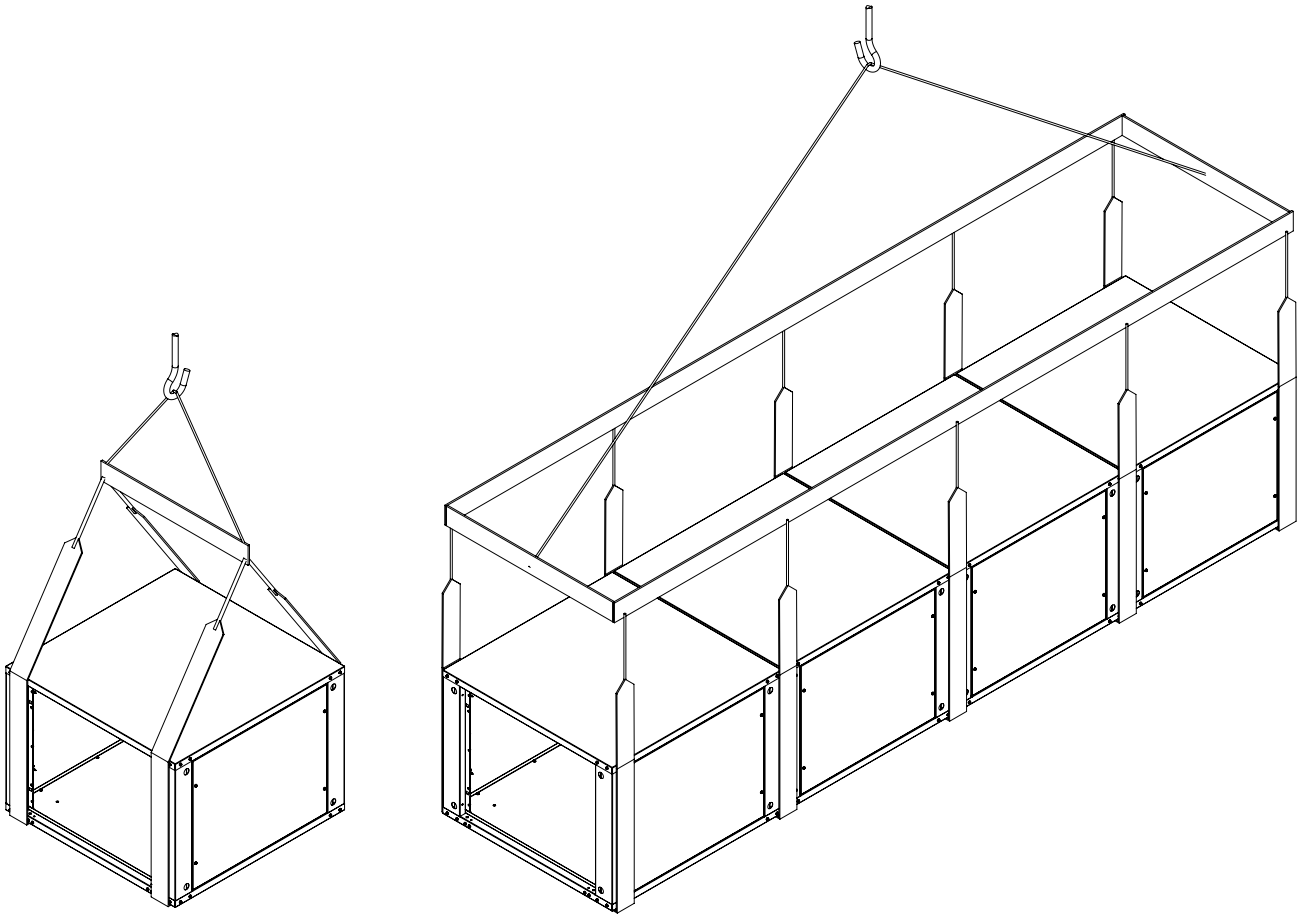


FIG. 2 - LIFTING UNITS WITHOUT BASE RAILS

c. Cover entire equipment with protective tarp or moisture proof cover. Extend cover under equipment if stored on ground. Secure cover with adequate tie downs or store indoors. Be sure that all piping connections have protective shipping caps installed.

d. Monthly - remove cover from unit, open fan access panel, remove belt ties and rotate fan and motor slowly by hand to redistribute the bearing grease and prevent bearing corrosion.

ASSEMBLING EQUIPMENT

All modules ship with the required bolts, nuts, screws and gasket material to assemble the equipment. Bolt/screw holes are accessible through the inside of the upstream module (Fig's 3 and 4).

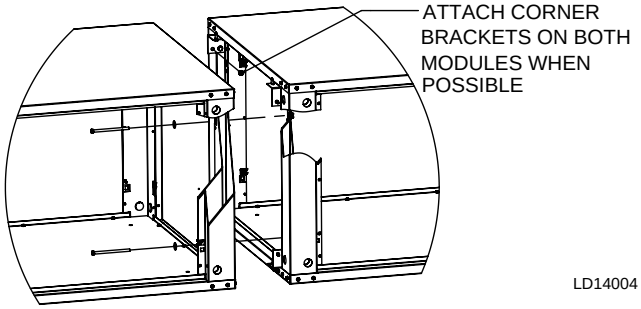


FIG. 3 - ASSEMBLY, UNITS WITHOUT BASE RAILS

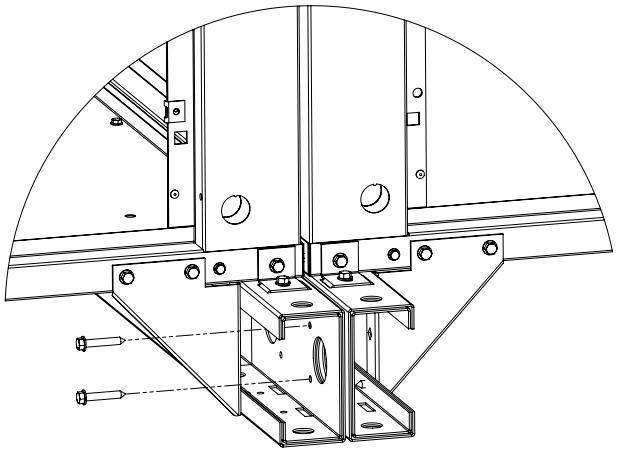


FIG. 4 - ASSEMBLY, UNITS WITH BASE RAILS

Gasketing

The gasketing material is supplied with each module for sections that need to be assembled on the job site.

1. Gasket the perimeter of each module. Overlap the gasketing approximately 1/8" when splicing. This will prevent air leakage between modules *(see Fig. 5)*.

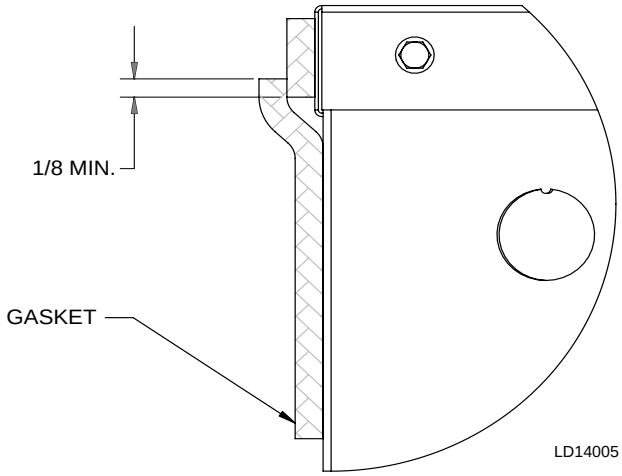


FIG. 5 - GASKET APPLICATION

Mounting Actuator

The Installing contractor takes all responsibility for the mounting of all field installed actuators. No requirements are made for the position of these actuators due to the number of options and arrangements available and the assortment of specific applications.

Attention should be taken to insure proper actuator support to prevent unnecessary stress in the linkage, cabinet, or damper shaft. Multiple damper assemblies must not be actuated from the shaft extension opposite the connection link.

Mixing Box

Fresh air and return air dampers can be connected together and driven from the same actuator if the dampers are the same size. If the dampers are different sizes they must be driven by individual actuators and controlled separately.

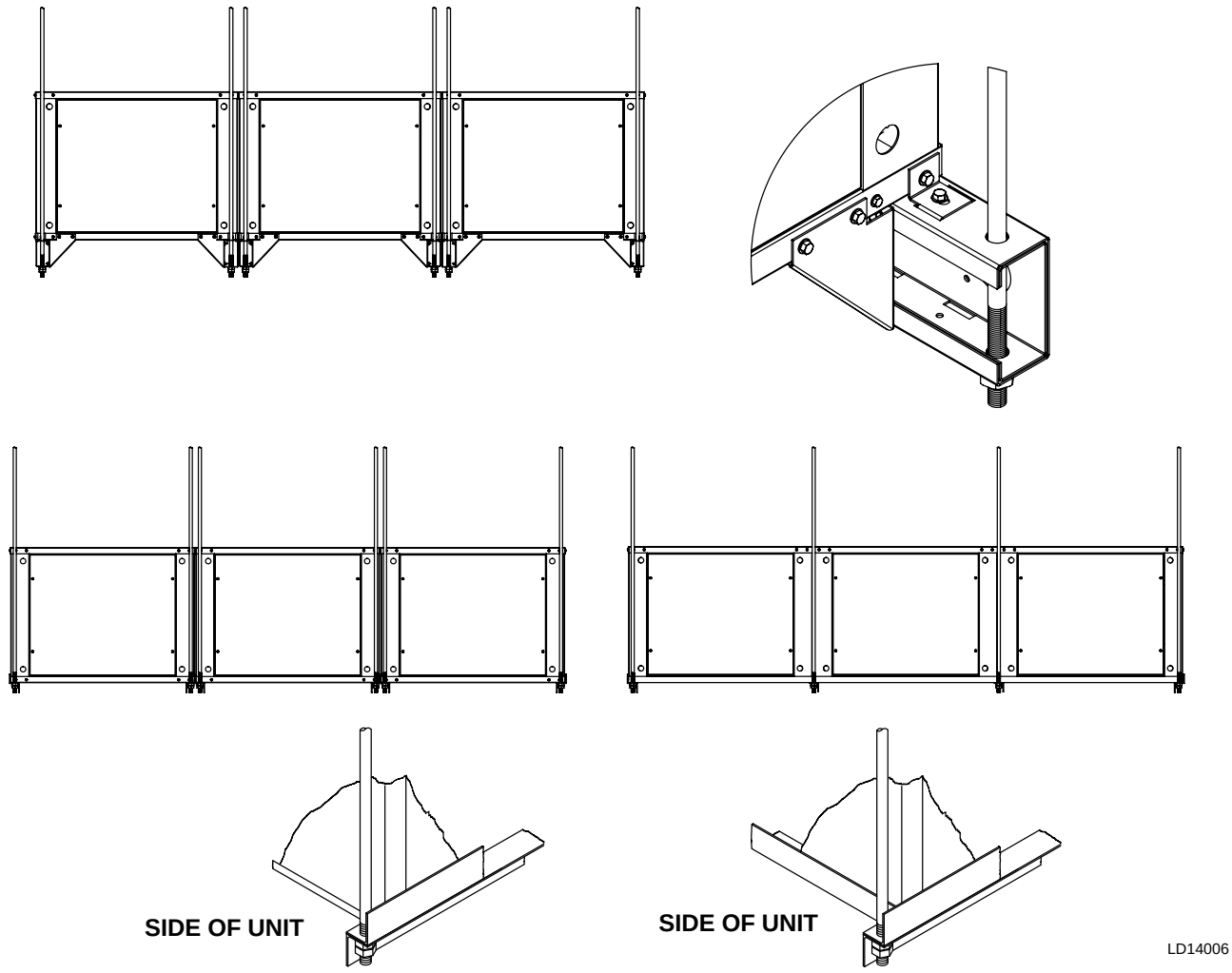


FIG. 6 - SUSPENDED UNITS

INSTALLATION

This equipment must be installed in strict accordance with any applicable local, state, and national codes including but not limited to building, electrical, and mechanical codes. On single wall equipment, lay rigid temporary protection, such as plywood, inside of equipment to protect insulation during installation.

Suspended Units

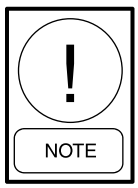
When the equipment is to be suspended from a ceiling, a base rail, angle iron, or channel must support the equipment. The MQL product line is not designed to be suspended from the top of the equipment. Before hanging the equipment, all field assembly must be completed.

Suspending Using Factory Base Rail

The factory optional base rails have a 5/8” diameter hole located in each corner for hanger rods. A hanger rod must be installed in each corner of a module to properly support the equipment and maintain unit’s structural integrity.

Suspending Using Field Supplied Supports

All field supplied structural supports must be designed to support entire unit weight including all appurtenances, motor, drives, and all live or dead loads. All supports must be designed to meet applicable local codes and ordinances. Each module must be supported with an angle iron or channel. The angle iron or channel must cover the width and length of the equipment base and must be designed to mechanically lock the unit to the field supports *(see Fig. 6).*



Hanger rods must be located so that they do not interfere with access panels.

Internal Isolation

Equipment may be supplied with internal spring isolation. If so, removal of shipping hold-downs is required before equipment start-up *(see Fig. 7).*

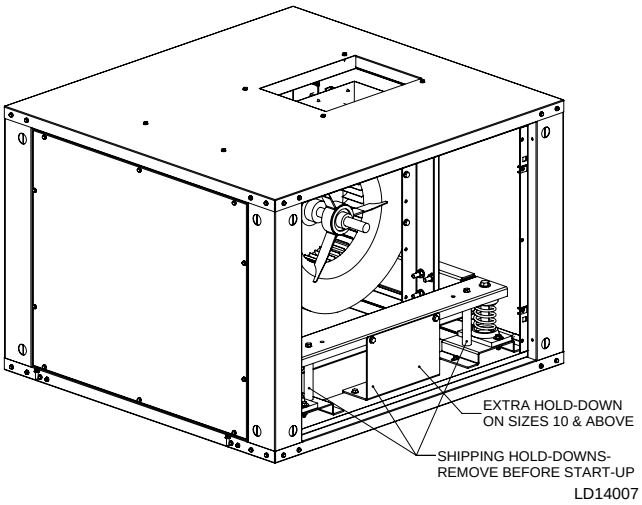


FIG. 7 - REMOVE HOLD DOWNS

External Isolation

Install vibration isolators *(see Fig. 8)* in accordance with the job specifications and the instructions of the isolator manufacturer base. Base rails are required for external isolation. If the coil module is also isolated, the piping must be isolated or have a flexible connection to prevent coil header damage due to equipment movement. All piping, wiring, ductwork and external connections must be isolated.

Service Clearance

Access to at least one side of the equipment is required for routine service, maintenance and repair. Consideration should be given to fan shaft, coil, filter removal, motor, fan, bearings, and damper linkage access. Clearance must meet or exceed applicable local and national codes.

Panel Removal

To remove access panels, loosen the four retaining screws and lift panel off. Alternately, lift off hinges with quick turn fasteners.

General Piping

All pipe connections need to be supported independently from the header. Failure to do so may cause cracking at the headers. All piping shall be in accordance with local codes and follow accepted industry standards. DX coil distributor cap for test and nitrogen charge must be removed before mounting TXV. All coil connections are stubbed out of cabinet panel with the exception of refrigerant (DX) coils. Field penetration of panels is required for liquid line piping.

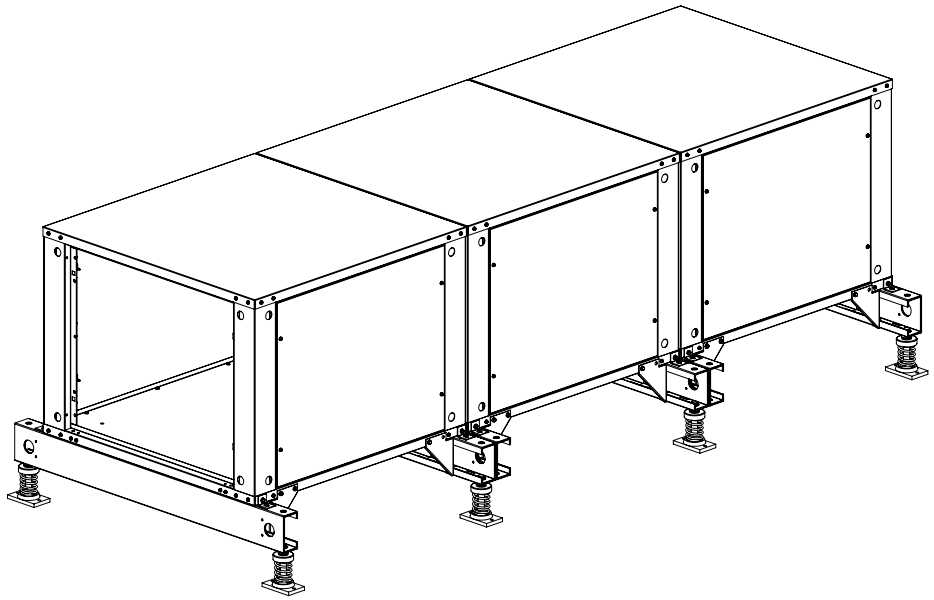


FIG. 8 - ISOLATOR INSTALLATION

Condensate Drain

All condensate drains must have a trap installed. This will prevent excessive condensate buildup and/or condensate overflow. To ensure that the trap remains sealed the trap depth and the distance between the pan outlet and the trap outlet should be twice the negative static pressure of coil module under normal operation *(see Fig. 9).*

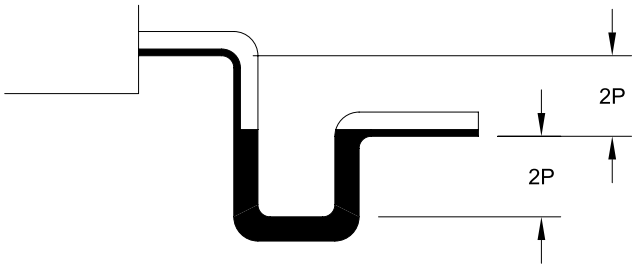


FIG. 9 - DRAIN TRAP

Electrical Installation

1. The Electrical service to the fan must be compatible to the rated voltage on the motor nameplate, and be in accordance with local codes.
2. The Fan segments metal casing must be connected to the buildings electrical ground on isolated units.
3. Door electrical interlock is not offered.
4. Some motors have internal automatic reset overload protection.
5. Thermal motor protection is external to the unit. Thermal protection and a disconnect switch are provided by others.
6. Review wiring diagram and make necessary connections accordingly.

BEFORE START-UP CHECK

Thorough safety precautions should always be taken when performing startup and service. Only qualified individuals should perform these tasks.

Before entering the fan section, make sure that the fan electrical power source is disconnected and locked in the “OFF” position.

1. Check that the unit is completely and properly installed with ductwork connected. Check that all construction debris is removed, and filters are cleaned.
2. Check that all electrical work is finished and properly terminated. Check that all electrical connections are tight and that the proper voltage is connected.
3. Motor and Ball bearings on fan shaft are prelubricated and do not need grease before startup.
4. Check tightness of setscrews in bearings and fan wheel(s). Make sure setscrews are torqued per Table 1.

Equipment damage due to loose setscrews or fasteners represents improper start-up and equipment abuse. It is not covered by the warranty.

5. Check tightness of sheave setscrews and/or capscrews. Check alignment of fan and motor sheaves and belt tension.
6. Rotate shaft manually by hand to make sure it is free.
7. Fan Startup: Start Fan, and observe the rotation. If the fan is operating backward, disconnect power and reverse two legs of the 3-phase supply power.
8. To ensure that water connections and joints are tight, leak test the piping systems.
9. Check that condensate drain is trapped.

START-UP

AC power current imbalance must not exceed 2%. Be sure that the following guidelines are met:

1. AC power is within 10% of rate voltage with frequency. *(See equipment nameplate for ratings).*
2. AC power is within 5% of rated frequency with voltage.
3. A combined variation in voltage and frequency of 10% (sum of absolute values) of rated values provided the frequency variation does not exceed 5% of rated frequency.

FIRST TIME MOTOR STARTUP

Check to see that all power to the equipment is off. Be sure that the motor shaft is disconnected from the load, and will not cause fan rotation.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. Ensure that all construction debris is removed from inside of equipment.
3. Check lubrication of fan, motor bearings and damper linkage
   a. Note that all bearings are shipped completely full of grease for corrosion protection. Bearings may run warm temporarily on startup until excess grease has discharged.
   b. Check tightness of bearing setscrews or locking collars. Also, check tightness of setscrews on fan wheel and sheave.
   c. Hand operate all damper linkage, to check freedom of movement.
4. If equipment has been in storage or idle for some time, check winding insulation integrity with megger.
5. Inspect all electrical connections for proper terminations, clearance, mechanical strength and electrical continuity.
6. Be sure that all shipping materials, braces, and construction debris are out of equipment.
7. Manually rotate motor shaft to ensure that it rotates freely.
8. Replace all panels that were removed during installation.
9. Momentarily apply power and check direction of rotation of motor shaft.
10. If motor rotation is wrong, be sure power is off and change the motor lead connections, verify rotation before you continue.
11. Start motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
12. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Ensure that motor is properly ventilated.

Air Balancing

When units are supplied with a variable pitch motor sheave, they are as a rule set to the mid rpm range. Field adjustment may be necessary to achieve required airflow. S*ee Drive Section of this IOM for variable pitch sheave adjustment instructions.*

When the final field alterations are concluded the current draw of the motors should be checked and compared to the full load current rating of the motor. The amperage must not be above that shown on the motor nameplate.

Sheaves

Upon completion of the air balance, it is a common industry recommendation that the variable pitched motor sheave be replaced with a properly sized fixed sheave. A matching fixed sheave will provide longer belt and bearing life and vibration free operation. Initially, it is best to have a variable pitched motor sheave for the purpose of air balancing, but once the balance has been achieved, fixed sheaves maintain balance and alignment more effectively. *See Drive Section of this IOM for variable pitch sheave adjustment instructions.*

PERIODIC MAINTENANCE AND SERVICE

General

The following checklist is provided as an abbreviated guide to periodic maintenance. Detailed procedural information is given after this checklist.

After 48 Hours of Operation

Belts will achieve their permanent stretch and will require re-adjustment, make sure not to over-tighten. *See Belt Section of this IOM for adjustment instructions.*

Weekly

Observe unit weekly for any changes in running condition and unusual noise.

Every Month

- Check air filters. Clean or replace if clogged or dirty.
- Re-lubricate fan bearings if operating conditions include high speeds, moist or dirty air, or high temperatures.
- Re-lubricate motor bearings in accordance with motor manufacturer's recommendations if operating conditions include high speed, moist or dirty air, or high temperatures. *See motor label.*
- Check and adjust fan belt tension.

Every Three to Six Months

- Check fan bearing grease line connections. Lines should be tight to the bearings.
- Re-lubricate fan bearings.
- Check motor lubrication. Recommendations are provided on the motor label.
- Check bearing and motor bracket bolt torque *(see Table 1).*
- Align fan and motor sheaves. Tighten sheave setscrews to the proper torque *(see Table 1).*
- Check and adjust fan belt tension.
- Tighten electrical connections
- Inspect coils for dirt build-up or coil freeze-up.

Every Year

- Inspect the units casing for corrosion. If damage is found, clean and paint the surface with a rust-resistant primer and vinyl chlorinated lacquer.
- Clean the fan wheel and fan shaft. Remove rust with an emery cloth and apply a coat of heavy duty rust inhibitor.
- Clean the coils. Using a fin comb straighten any bent fins.
- Inspect the condensate pan and drain line; remove sludge or foreign materials that might obstruct proper drainage. Remove obstructions.
- Check damper linkages, set screws and blade adjustment. Clean, but do not lubricate, the nylon damper rod bushings.
- Clean damper operators.
- Inspect the control and power box wiring for secure connections and insulation.
- Rotate the fan wheel and check for obstructions in the fan housing. The wheel should not rub on the fan housing. Adjust the wheel to center if necessary and tighten wheel setscrews to the proper torque *(see Table 1).*
- Check condition of gasketing and insulation around unit, door and dampers. Repair or replace as necessary.
- Examine flex connections for cracks or leaks. Repair or replace damaged material.

TABLE 1 - MINIMUM HEX HEAD BOLT TORQUE IN LB-FT - GRADE 5 BOLT

Size (inches*)	Thread Designation	Min. Torque
¼-20	UNC	6
5/16-18	UNC	14
5/16-24	UNF	16
3/8-16	UNC	24
3/8-24	UNF	28
7/16-14	UNC	42
7/16-20	UNF	45
½-13	UNC	69
½-20	UNF	83
9/16-12	UNC	99
9/16-18	UNF	118
5/8-11	UNC	150
5/8-18	UNF	176
¾-10	UNC	254
¾-16	UNF	301
7/8-9	UNC	358
7/8-14	UNF	422
1-8	UNC	500
1-14	UNF	602

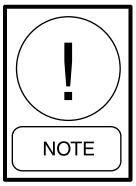
Drain Pan

Inspecting and Cleaning Drain Pans

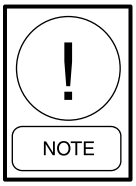
If evidence of standing water or condensate overflow exists, identify and remedy the cause immediately. (Refer to the troubleshooting section for possible causes and solutions.) If microbial growth (mold) in the drain pan is observed, clean the pan immediately using the following procedure:

1. Disconnect all electrical power to the unit, tag and lock out power source.
2. Put on appropriate personal protective equipment.
3. Remove all standing water.
4. Use a scraper or other tools to remove any solid matter. Remove solid matter with a vacuum device that uses high efficiency particulate arrestance (HEPA) filters with a minimum efficiency of 99.97% at 0.3-micron particle size.

5. Thoroughly clean the contaminated area with mild bleach and water solution or an EPA-approved sanitizer specifically designed for HVAC use. Carefully follow the sanitizer manufacturer instructions regarding the use and the disposal of their product.
6. Immediately rinse the drain pan thoroughly with fresh water to prevent potential corrosion from the cleaning solution of the drain pan and drain line components.
7. Allow the unit to dry thoroughly before putting the system back into service.
8. Determine and correct the cause of the microbial contamination.
9. Be careful that the contaminated material does not contact other areas of the unit or building.



Properly dispose of all contaminated materials and cleaning solution.



IMPORTANT: Standing water in drain pans can promote microbial growth (mold) that may cause unpleasant odors and serious health-related indoor air quality problems. If mold is found, it must be removed immediately and that portion of the unit properly cleaned and sanitized.

Air Filters

Catalog data tables provide filter size, type and quantity.

Throwaway Filters

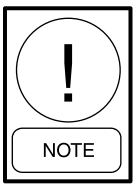
To replace throwaway filters, install new filters with the directional arrows pointing in direction of airflow.

Fans

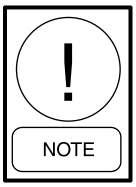
Inspecting and Cleaning Fans

Fan sections or air handlers should be inspected every six months at a minimum or more frequently if operating experience dictates. Accumulated dirt and organic matter on the interior surfaces of fans should be cleaned immediately. The suggested procedure for cleaning these surfaces is:

1. Disconnect all electrical power to the unit, tag and lock out power source.
2. Put on appropriate personal protective equipment.
3. Use a portable vacuum with HEPA filtration to remove the loose dirt and organic matter. The filter should be 99.97% efficient at .3 micron particle size.
4. If no microbial growth (mold) exists, thoroughly clean the fan and associated components with an industrial cleaning solution. Carefully follow the cleaning solution manufacturer instructions regarding use and disposal of their product.
5. If microbial growth (mold) is present remove the contamination, and thoroughly clean the affected area with an EPA-approved sanitizer specifically designed for HVAC use. Carefully follow the sanitizer manufacturer instructions regarding the use and disposal of their product.
6. Rinse the affected surfaces thoroughly with fresh water and a fresh sponge to prevent potential corrosion of metal surfaces.
7. Allow the unit to dry completely before putting it back into service.
8. Use caution to assure that any contaminated material does not contact other areas of the unit or building.



Properly dispose of all contaminated materials and cleaning solution.



IMPORTANT: If the microbial growth (mold) was found, the cause of the contamination must be determined and action taken to assure it does not reoccur.

Fan Bearings

Bearing Set Screw Alignment

Align bearing setscrews. *See Table 1 for bearing setscrew torque.*

Fan Bearings should be lubricated with a lithium base grease which conforms to NLGI Number 2 for consistency. *See Tables 2, 3 and 4 for recommended greasing intervals, operating range, and bearing grease capacities.*

TABLE 2 - RECOMMENDED GREASING INTERVALS OF FAN BEARINGS

Operating Conditions	-20°F to +140°F	140°F to 200°F
Clean, Dry	3-6 months	1-3 weeks
Dirty, Dry	1-3 months	1-4 weeks
Dirty, Wet, High Humid	1-4 weeks	1-14 days

TABLE 3 - RECOMMENDED GREASES FOR VARIOUS OPERATING RANGES

Recommended Greases	Recommended Operating Range
Texaco-Multi Fak #2	-20°F to +250°F
Shell Alvania #2	-20°F to +250°F
Mobil Mobilux #2	-20°F to +250°F
Exxon Unirex #2	-20°F to +250°F
Exxon Beacon	-65°F to +250°F

TABLE 4 - FAN BEARING MAXIMUM GREASE CAPACITY

Shaft Size in inches	Capacity in fl. Oz.
1/2 – 3/4	1/8
7/8 – 1-3/16	3/8
1-1/4 – 1-1/2	5/8
1-11/16 – 1-15/16	7/8
2 – 2-7/16	1-1/4
2-1/2 – 2-15/16	2

To lubricate the fan bearing, complete the following:

1. Disconnect all electrical power to the unit, tag and lock out power source.
2. Check grease lines for tight connections at the grease fitting.
3. Using a manual low-pressure grease gun, add grease until a light bead appears at the bearing grease seal. Turn the fan wheel manually while adding grease.

Motor

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every three months, which ever occurs first. Operating conditions will vary the frequency of inspection and lubrication. Table 5 lists recommended motor greasing intervals. Keep the motor clean and the ventilation opening clear. The following steps should be performed at each inspection:

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. This can accumulate and block motor ventilation. If the motor is not properly ventilated over heating can occur and can cause early motor failure.
2. Use “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the “Megger” readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.
4. Check that all mechanical fasteners are properly tightened.

TABLE 5 - RECOMMENDED MOTOR GREASING SCHEDULE

Average Daily Operating Hours	Ambient Temp. Maximum	Average Environment	.25 to 7.5 HP Motors	10 HP Motors
8-16	40°C	Clean and Dry	Every 5 years	Every 3 years
12-24	50°C	Moderate Dirt or Moisture	Every 2 years	Every year
Any	>50°C or Class H Insulation	Severe (very dirty or high temperatures)	Every 6 months	Every 3 months

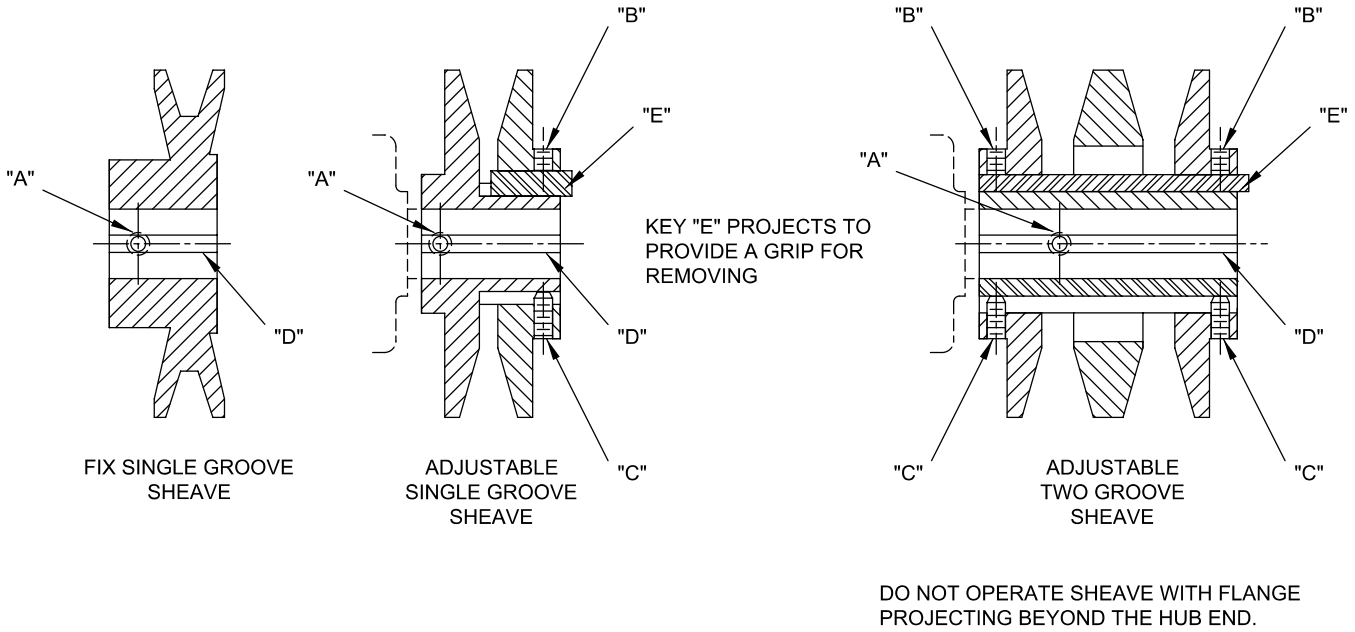


FIG. 10 - MOUNTING SHEAVES

Lubrication and Bearings

Bearing grease will lose its lubrication ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

The recommended lubrication interval for 1800-RPM motor, up to and including NEMA frame 215T is every 12000 hours of operation. It is important to remember that this recommendation is base of average use. Refer to Table 2 for additional information.

Types of Grease

A high-grade ball or roller bearing grease should be used. *See Table 3 for Recommended Greases.*

Chevron SRI (Factory Installed) - Polyurea Base

Lubrication Procedure

Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your factory representative if a grease other than the recommended type is to be used.

To avoid damage to motor bearings, grease must be kept free of dirt.

With Grease Outlet Plug

1. Clean grease fitting.
2. Remove grease outlet plug.
3. If motor is stopped, add the recommended amount of grease. If motor is to be greased while running, a slightly greater quantity of grease will have to be added. Add grease slowly until new grease appears at shaft whole in the endplate or purge outlet plug.
4. Re-install grease outlet plug.

Without Grease Outlet Plug

1. Disassembly motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about ½ full of grease.)
3. Assemble motor.

To re-lubricate the motor, consult the maintenance tag provided on the motor.

Refer to Table 1 for minimum torque of motor mounting and bearing bolts.

Drives

Mounting Straight Bore Sheaves

1. Make sure there are no nicks or burrs on key, keyway and shaft. If so, remove by proper methods.
2. Check key size with both the shaft and the sheave.
3. All straight bore sheaves should be mounted on the motor or driver shaft with setscrew (A) toward the motor *(see Fig. 10).* The sheave should be close to the motor as possible with setscrew (A) in full contact with the key.

If the setscrew (a) is not fully in contact with the key, the sheave assembly could come off.

4. Be sure that both the driver and driven sheaves are in alignment and that the shafts are parallel. The centerline of the driver sheave must line up with the centerline of the driven sheave. Angle "A" cannot exceed 1/2º *(see Fig. 11).*

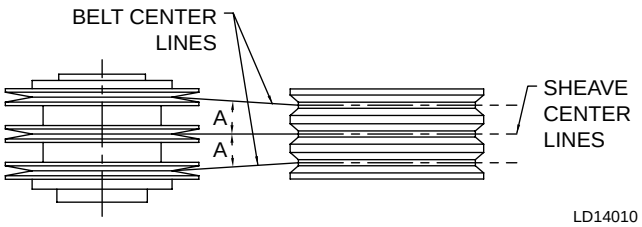


FIG. 11 - SHEAVE ALIGNMENT

5. Insert key (D) between the sheave and the shaft and tighten setscrew (A) in place using torque value from Table 1.
6. Put on belts and adjust belt tension properly. Refer to Belt Section for tensioning instructions.
7. Be sure that all keys are in place. Make sure all setscrews and capscrews are torqued properly before starting drive. Check setscrew and belt tension after 24 hours of service.

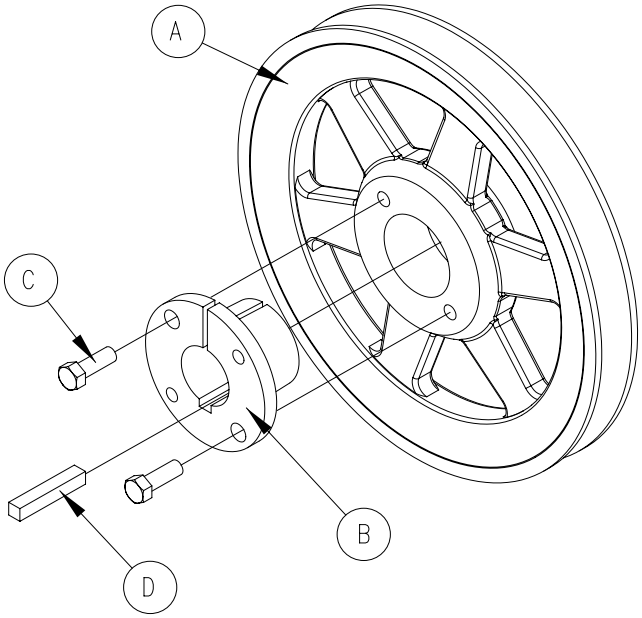


FIG. 12 - SPLIT TAPPER SHEAVE MOUNTING

Mounting Split Tapper Sheaves
(See Fig. 12)

1. Make sure there are no nicks or burrs on the key, keyway, and shaft. If so, remove by proper methods.
2. Remove any oils, lubricants or contaminants from the bushing, capscrew, and tapered bore.
3. Check key size with both the bushing and the shaft.
4. Put bushing (B) loosely in hub of sheave (A). Do not press tight onto drive. Start capscrew (C) by hand, turning them just enough to engage the threads in the tapered holes on hub. Do not use wrench at this time. The bushing should be loose enough in the hub to move slightly.
5. Slide assembly on to shaft making allowance for endplay of shaft to prevent rubbing. Do not force assembly on shaft. If it does not go on easily, check shaft, bushing, and key size.
6. Be sure that both the driver and driven sheaves are in alignment and that the shafts are parallel. The centerline of the driver sheave must line up with the centerline of the driven sheave. Angle "A" cannot exceed 1/2º *(see Fig. 11).*

7. Insert key (D) between the sheave and the shaft.
8. Tighten capscrews progressively with wrench. Do this following a star pattern, taking a partial turn on each capscrew successively until all are tight *(see Table 1 for proper torque).*

NOTE

Do not attempt to pull flange flush with hub - some gap should remain between flange and hub after tightening.

9. Put on belt and adjust belt tension properly. *Refer to Belt Section for tensioning instructions.*
10. Be sure that all keys are in place. Be sure that all setscrews and capscrews are torqued properly before starting drive. Check setscrews and belt tension after 24 hours of service.

Adjust Variable Pitched Sheaves

(provided on motor only). *See Fig. 10.*

1. Slack off all belt tension by moving motor towards blower shaft until belts are free of groove(s). For easiest adjustment, remove belts from groove(s).
2. Loosen setscrew (B) in outer locking ring.
3. Loosen but do not remove capscrew.
4. Remove key (D).

NOTE

This key projects a small amount to provide a grip for removal.

5. Adjust pitch diameter by opening or closing the movable flange(s) by a half or full turn. Opening the flange(s) will decrease the blower speed, closing the flange(s) will increase blower speed.

NOTE

Two groove sheaves are supplied with both grooves set at the same pitch diameter. Both movable flanges must be rotated the same number or turns to ensure the same pitch diameter for satisfactory operation.

WARNING

Do not open sheaves more than five turns for "a" belt or 6 turns for "b" belt. Doing so may cause the belts to sit improperly, and cause the flanges to detach in service.

6. Replace key (D).
7. Tighten setscrew (B) in outer locking ring and capscrew (C) with torque wrench to the values in the Table 1.
8. Put on belts and adjust belt tension properly. *Refer to Belt Section for tensioning instructions.*
9. Be sure that all keys are in place. Be sure that all setscrews and capscrews are torqued properly before starting drive. Check setscrews and belt tension after 24 hours of service.

Belts

Adjusting Belt Tension.

See Fig. 13

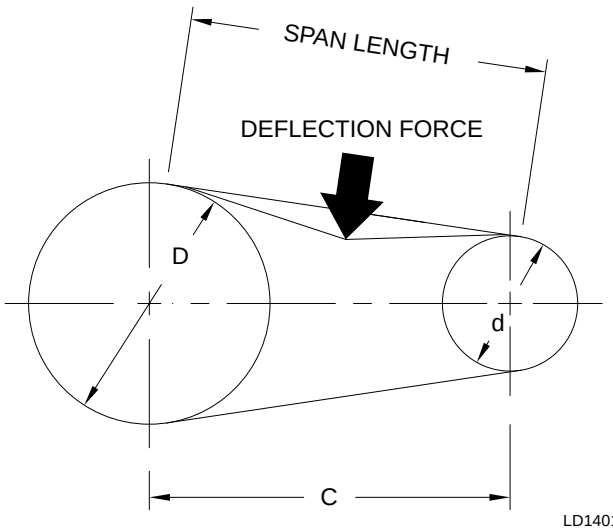


FIG. 13 - BELT TENSION

1. Measuring belt span. Lay a tape measure along the top of the belt, measure between the points at which the outside of the belt meets the outside of the sheaves. The following formula can be used to calculate the belt span.

$$Span = \sqrt{C^2 - \left(\frac{D-d}{2}\right)^2}$$

LD14003

C = Center distance shaft to shaft
D = Driver sheave (large sheave) pitch diameter
d = Driver sheave (small sheave) pitch diameter

TABLE 6 - DETERMINING DEFLECTION FORCE				
Belt Cross Section	**Smallest Sheave Diameter Range**	**RPM Range**	**Belt Deflection Force**	
			Used Belt	**New Belt**
A	3.0 - 3.6	400 - 2500 2501 - 4000	3.7 2.8	5.5 4.2
	3.8 - 4.8	400 - 2500 2501 - 4000	4.5 3.8	6.8 5.7
	5.0 - 7.0	400 - 2500 2501 - 4000	5.4 4.7	8.0 7.0
B	4.4 - 5.6	860 - 2500 2501 - 4000	5.3 4.5	7.9 6.7
	5.8 - 8.6	860 - 2500 2501 - 4000	6.3 6.0	9.4 8.9

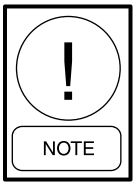
2. Calculate deflection (Deflection = Span ÷ 64)
3. *See Table 6 for correct deflection force.*
4. Using a spring scale, apply force at right angle to the midpoint of the belt span *(see Fig. 13).*
5. Check the tension at least twice during the first day of operation, and periodically there after.

How to Increase Belt Life

- Keep sheaves and belts clean. Abrasive dust, rust, oils, and acids reduce service life.
- Give drives clearance. Never let belts run against belt guards or other obstructions.
- Never force belts. Move motor on adjustment base so belts go on easily.
- Eliminate slack. Adjust motor and tighten belts in position. Slack belts wear excessively which cause slippage and deliver less air.
- Use matched belts. Matched belts run smoother and last longer because the load is evenly distributed. Never partially replace a set of belts.
- Mount belts straight. Shaft must be parallel and sheave grooves in alignment to prevent unnecessary belt wear.
- Do not overload belt. Belts have a specific HP rating that must not be exceeded.

Coils

The frequency of required cleaning is dependent on the operating hours of the system, filter maintenance and efficiency as well as dirt load.



IMPORTANT: Coils may become externally fouled as result of normal operation. Dirt on the surface of the coil reduces its ability to transfer heat that can result in reduced performance, and increased operating energy costs. If the dirt on the surface of the coil becomes wet, which commonly occurs with cooling coils, microbial growth (mold) can result, in turn causing unpleasant odors and serious health related indoor air quality problems.

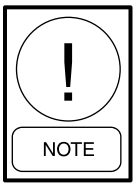
Fin edges are sharp. Fins are fragile; care must be exercised to avoid damaging fins.

Steam, Hot Water and Chilled Water Coils

Steam, hot water, and chilled water coils should be kept clean to maintain maximum performance. If fins become dirty, clean with steam and detergent, hot water spray and detergent, or one of the commercially available chemical coil cleaners. Rinse coils thoroughly after cleaning.

1. Disconnect all electrical power to the unit, tag and lock out power source.
2. Put on appropriate personal protective equipment.
3. Gain access to the coil section of the unit.
4. Use a soft brush to remove loose debris from sides of the coil.

5. Use a steam-cleaning machine, starting from the top of the coil and working downward. Clean the leaving airside of the coil first, then the entering airside. Use a block-off to prevent steam from blowing through the coil and into dry sections of the unit.
6. Repeat step 5 as necessary.
7. Confirm that the drain line is open following the cleaning.
8. Allow the unit to dry thoroughly before putting the system back in service.
9. Straighten any coil fins that may have been damaged during the cleaning process with a fin comb.
10. Replace all panels and parts and restore electrical power to the unit.
11. Use caution to assure that any contaminated material does not contact other areas of the unit or building.

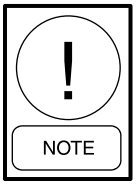


Properly dispose of all contaminated materials and cleaning solutions.

Refrigerant Coils

Refrigerant coils should be kept clean to maintain maximum performance. If fins become dirty, clean with cold water and detergent, or one of the commercially available chemical coil cleaners. Rinse coils thoroughly after cleaning.

1. Follow steps 1-4 from Steam and Water Coil cleaning procedure preceding.
2. Mix a high quality coil cleaning detergent with water accordance to the manufacturer's instructions. If the detergent is strongly alkaline after mixing (pH 8.5 or higher), it must contain an inhibitor. Carefully follow the detergent manufactures instructions on the use of the product.
3. Place the mixed solution in a garden sprayer or high-pressure sprayer. If a high pressure sprayer is used note the following:
   - Maintain a minimum nozzle spray angle of 15 degrees.
   - Spray perpendicular to the coil face.
   - Protect other areas of the air handler and internal controls from contact with moisture or the cleaning solution.
   - Keep the nozzle at least 6 inches from the coil.
   - Do not exceed 600 psi.
4. Spray the leaving airside of the coil first, then the entering airside. Use a block-off to prevent spray from going through the coil and into dry sections of the unit and/or system ductwork. Carefully follow the cleaning solution manufacturer's usage instructions.
5. Thoroughly rinse both sides of the coil and the drain pan with cool, clean water.
6. Repeat steps 4 and 5 as necessary.
7. Straighten any coil fins that may have been damaged during the cleaning process with a fin comb.
8. Confirm that the drain line remains open following the cleaning process.
9. Replace all panels and parts and restore electrical power to the unit.
10. Use caution to assure that any contaminated material does not contact other areas of the unit or building.



Properly dispose of all contaminated materials and cleaning solutions.

Winterizing Water Coils

Due to air stratification, failure of outdoor air dampers and/or preheat controls, coil freeze-up can occur. Scheduled draining of water cooling coils for winter shutdown cannot be depended upon as insurance against interior tube freezeup. Freeze-up will result in severe coil damage. It is recommended that all coils be drained as thoroughly as possible and then treated in the following manner.

Fill each coil independently with an anti-freeze solution using a small circulating pump and again thoroughly drain. Check freezing point of anti-freeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be a diluting effect. The small amount of anti-freeze solution remaining in coil must always be sufficient enough to prevent freeze-up.

Carefully read instructions for mixing anti-freeze solution used. Some products will have a higher freezing point in its natural state than when mixed with water. The freezing of coils is not the responsibility of ENVIRO-TEC®.

OPERATING GUIDELINES

Operating Limits

Do not exceed the operating limits in Table 7. A fan wheel that is operated beyond the rpm and temperature limits shown may suffer permanent distortion or failure.

Vibration Levels

Each unit that is shipped has been trim-balanced to function properly. Although the factory requirements are much tighter, to assure satisfactory operation after enduring the rigors of shipping and installation. The following is accepted industry guidelines for field-balancing fans found in Table 8.

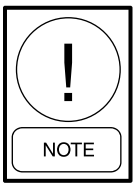
Vibration Causes

1. Wheel imbalance.
   a. Dirt or debris on wheel blades.
   b. Loose setscrews in wheel hub or bearing-to-shaft.
   c. Wheel distorted from over-speed.
   d. Wheel balance weight missing.
2. Bent blower shaft.
3. Drive faulty.
   a. Variable pitch sheaves - Axial and radial runout of flanges; uneven groove spacing; out of balance. Also similar fault in driven sheave.
   b. Bad V-belts; lumpy, or mismatched belts.
   c. Belt tension too tight or loose.
4. Bad bearings, loose bearing hold-down bolts.
5. Motor imbalance.
6. Fan section not supported evenly on foundation.
7. Fan shaft not parallel with motor shaft.

Periodic Service and Maintenance

1. Check all moving parts for wear every six months.
2. Check bearing collar, sheave, and wheel hub setscrews, sheave capscrews, and bearing hold-down bolts for tightness every six months.

APPLICATION RECOMMENDATION FOR COILS



Observe all local codes and industry standards

General

Piping design, sizing, and installation information presented in the ASHRAE Handbooks should, be followed in the design and installation of piping.

Water Cooling Coils

1. Water supply, water return, drain and vent connections are labeled on the end panel.
2. Water supply and water return connections are checked.
3. Avoid undue stress to the connection extending through unit panel. Use backup pipe wrench to avoid breaking the weld between coils connection and header.
4. Follow recommendations of the control manufacturer regarding types, sizing and installation of control valves.

TABLE 7 - FORWARD CURVE FAN DATA

Diameter	9 x 4	9 x 6	10 x 7	12 x 9	12 x 12	15 x 11	18 x 13	18 x 18
Maximum RPM Class I	4800	3600	2800	2300	2000	1600	1200	1200
Maximum RPM Class II	N/A	N/A	N/A	N/A	N/A	1700	1475	450

Note: Maximum air temperature through fan section is 225°F (107°C)

TABLE 8 - VIBRATION LEVELS

Fan Speed (RPM)	Vibration
800 or less	5 mils maximum displacement
801 or greater	.20 in/sec. Maximum velocity

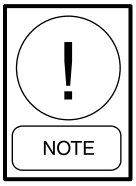
Note: Excessive vibration from any cause contributes to premature fan and motor bearing failure. Overall, vibration levels should be monitored every six months of operation. An increase in levels is an indication of potential trouble.

Direct Expansion Coils

1. The coil suction connection extended through the end panel of the coil section. The coil distributor is located inside the cabinet on the same side as the suction connection.
2. DX coils are shipped capped and sealed with a 20 PSIG holding charge of dry nitrogen. Remove nitrogen charge from coil by depressing Schraeder stem, prior to cap removal.
3. Check nozzle in distributor for proper tonnage.
4. When a thermostatic expansion valve is supplied with the unit, it will be shipped loose with the unit and field installation directly to the distributor will be required.
5. Do not apply heat to the body or thermal element of the expansion value. Wrap in wet rag while brazing.
6. The thermostatic expansion valve must be of the external equalizer tube type. Connect the ¼-inch diameter external equalizer tube provided on the coil to connection on expansion valve.
7. Care should be exercised when piping up the system to be sure all joints are tight and all lines are dry and free of foreign material.

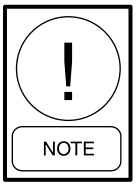
Steam Coils
(maximum steam pressure is 15 PSIG)

1. Steam supply and steam return connections are male N.P.T. copper pipe and are labeled on the end panel of coil section. Connections extend through coil section end panel.
2. When installing couplings, do not apply undue stress to the connection extending through unit panel. Use backup pipe wrench to avoid breaking the weld between coil connection and header.
3. Support piping independently of coils and provide adequate piping flexibility. Stresses resulting from expansion of closely coupled piping can cause serious damage.
4. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to trap.
5. It is recommended that vacuum breakers be installed on all applications to prevent retaining condensate in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the return main, the vacuum breaker should be open to the atmosphere and the trap design should allow venting of large quantities of air.
6. Do not drip supply mains through the coil.
7. Do not attempt to lift condensate when using modulating or on/off control.
8. Size traps in accordance with manufacturers' recommendations. Be certain that the required pressure differential will always be available.



Do not undersize.

9. Float and thermostatic or bucket traps are recommended for low-pressure steam. Thermostatic traps should be used only for air venting.
10. Locate traps at least 12 inches below the coil return connection.
11. Multiple coil installation.
    a. Each coil or group of coils that is individually controlled must be individually trapped.
    b. Coils in series: Separate traps are required for each coil, or bank of coils, in series.
    c. Coils in parallel: A single trap may generally be used but an individual trap for each coil is preferred.
    d. Do not attempt to lift condensate when using modulating or on/off control.
12. With coils arranged for series airflow, a separate control is required on each back or coil in the direction of airflow.
13. Modulating valves must be sized properly.



Do not undersize.

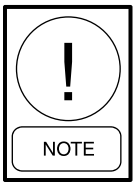
14. Freezing conditions (entering air temperature below 35ºF)
    a. 5-psi steam must be supplied to coils at all times.
    b. Modulating valves are not recommended. Control should be by means of face and bypass dampers.
    c. Consideration should be given to the use of two or three coils in series with two position steam control valves on that coil or coils which will be handling 35ºF, or colder, air. The desired degree of control can be obtained with a modulating valve on the downstream coil.
    d. Provision should always be made to thoroughly mix fresh air and return air before it enters the coil. In addition, temperature control elements must be properly located to obtain true air mixture temperatures.
    e. As additional protection against freeze-up, the trap should be installed sufficiently below coil to provide an adequate hydrostatic head to ensure removal of condensate during an interruption in the steam pressure. Estimate 3 feet for each 1-psi of trap differential required.
    f. On startup, admit steam to coil ten minutes before admitting outdoor air.
    g. Provision must be made to close fresh air dampers if steam supply pressure falls below minimum specified.

Water Heating Coils

1. Water supply and water return connections extend through the end panel of the coil section. All connections are labeled on the end panel.
2. Water supply and water return connections are male N.P.T copper pipe.
3. When installing couplings, do not apply undue stress to the connection extending through unit panel. Use a backup pipe wrench to avoid breaking the weld between coil connection and header.
4. Follow recommendations of the control manufacturer regarding types, sizes and installation of control valves.
5. Hot water coils are not recommended for use with entering air below 40ºF.
6. If fresh air and return air are to be heated by a hot water coil, care should be used in the design of the system to assure thorough mixing before air enters the coil

TROUBLESHOOTING

Use Table 9 to assist in identifying the cause or cause of malfunction in the MQL.



This table is intended as a diagnostic aid only. For detailed repair procedures, contact your ENVIRO-TEC ® representative.

TABLE 9 - MQL TROUBLESHOOTING ANALYSIS

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
BEARING IS EXCESSIVELY HOT	First start after relubrication (grease distribution).	Allow machine to cool down and restart.
	Over-lubrication.	Clean surfaces of grease and purge.
	Over tensioned belts.	Adjust belt tension.
	No lubrication.	Apply lubricant. Check bearing for damage.
	Misaligned bearing.	Correct alignment. Check shaft level.
MOTOR FAILS TO START	Blown fuse or open circuit breaker.	Replace fuse or reset circuit breaker.
	Overload trip.	Check and reset overload.
	Improper wiring connections.	Check wiring with diagram supplied on unit.
	Improper current supply.	Compare actual supply power with motor nameplate recommendations. Contact power company for adjustments.
	Mechanical failure.	Check that motor and drive rotate freely. Check bearing lubricant.
MOTOR STALLS	Open phase.	Check line for an open phase.
	Overloaded motor.	Reduce load or replace with larger motor.
	Low line voltage.	Check voltage across AC line. Correct voltage if possible.
EXCESSIVE VIBRATION	Poor alignment.	Align bearing setscrews *(see Fig. 8).* Loosen and retighten bearing setscrew.
	Shipping spacers not removed.	Remove shipping spacers and/or bolts.
	Over tensioned belts.	Adjust belt tension.
	Misaligned drive.	Align drive.
MOTOR RUNS AND THEN DIES DOWN	Partial loss of line voltage.	Check for loose connections. Determine adequacy of main power supply.
	Stator shorts when motor warms up.	Replace motor.
MOTOR DOES NOT COME UP TO SPEED	Low voltage at motor terminals.	Check voltage across AC line and correct voltage loss if possible.
	Line wiring to motor too small.	Replace with larger sized wiring.
MOTOR OVERHEATS	Overloaded motor.	Reduce load or replace with a larger motor.
	Motor fan is clogged with dirt.	Remove fan cover, clean fan and replace preventing proper ventilation cover.
	Temperature leaving heating section is too high.	Increase airflow volume, reduce hot water inlet temperature, turn thermostat down.

TABLE 9 - MQL TROUBLESHOOTING ANALYSIS		
SYMPTOM	**PROBABLE CAUSE**	**RECOMMENDED ACTION**
EXCESSIVE MOTOR NOISE	Motor mounting bolts loose.	Tighten motor mounting bolts.
	Rigid coupling connections.	Replace with flexible connections.
	Worn motor bearings.	Replace bearings and seals.
	Fan rubbing on fan cover.	Remove interference in motor fan housing.
RAPID MOTOR BEARING WEAR	Excessive overhung load due to over-tensioned drive.	Check belt tension and overhung load.
	Excessive overhung load due to a small diameter motor sheave.	Replace sheave with larger one.
LOOSE FAN BELT	Motor is poorly positioned.	Adjust belt tension.
	Worn or damaged belts.	Replace belt or belt set. Check sheave alignment.
	Worn sheaves.	Replace sheaves.
SHORT BELT LIFE	Worn sheaves.	Replace sheaves.
	Misaligned belt.	Realign drive with MVP sheave set at mean pitch diameter.
	Grease or oil on belts.	Check for leaky bearings. Clean belts and sheaves.
	Belt slipping.	Adjust tension.
	Belts rubbing.	Remove obstruction or realign drive for clearance
BEARING NOISE	Poor alignment.	Loosen bearing setscrews and realign *(see Fig. 10).*
	Inadequate lubrication.	Grease bearing(s).
LOW COIL CAPACITY (CHILLED WATER)	Air is bypassing coil.	Prevent bypass with block-offs.
	Coil tubes are blocked.	Clean and unblock tubes.
	Incorrect airflow.	Check fan operating conditions.
	Incorrect gpm.	Check water pumps, valves and lines for obstructions.
	Incorrect water temperature.	Provide proper water temperature.
LOW COIL CAPACITY (REFRIGERANT)	Air is bypassing coil.	Prevent bypass with block-offs.
	Coil tubes are blocked.	Clean and unblock tubes.
	Incorrect airflow.	Check fan operating conditions.
	Expansion valve not operating.	Check sensing bulb location and TXVN operation.
	Poor refrigerant distribution.	Check for blockage in distributor and tubes.
DRAIN PAN IS OVERFLOWING	Plugged drain line.	Clean drain line.
	Unit not level.	Level unit.
STANDING WATER IN DRAIN PAN	Improper trap design.	Design trap for unit.
EXCESS DIRT IN UNIT	Missing filters.	Replace filters.
	Filter bypass.	Reduce filter bypass.
MOLD INSIDE AIR HANDLER	Standing water in drain pan.	*See “Standing water” symptoms.*

INSPECTION & START-UP CHECKLIST

Receiving & Inspection

- ❑ Unit Received Undamaged
- ❑ Unit Received Complete As Ordered
- ❑ Unit Arrangement/Hand Correct
- ❑ Unit Structural Support Complete & Correct

Handling & Installation

- ❑ Unit Mounted Level & Square
- ❑ Proper Access Provided For Unit & Accessories
- ❑ Proper Electrical Service Provided
- ❑ Proper Overcurrent Protection Provided
- ❑ Proper Service Switch/Disconnect Provided
- ❑ Proper Hot Water Line To Unit
- ❑ Proper Chilled Water Line Size To Unit
- ❑ Proper Steam Line Sizes To Unit
- ❑ Proper Refrigerant Line Sizes To Unit
- ❑ Proper Steam Supply Pressure To Unit (15psi Max)
- ❑ Proper Steam Condensate Trap On Return Line
- ❑ All Shipping Screws & Braces Removed
- ❑ All Services To Unit In Code Compliance

Cooling/Heating Connections

- ❑ Protect Valve Package Components From Heat
- ❑ Mount Valve Packages
- ❑ Connect Field Piping To Unit
- ❑ Pressure Test All Piping For Leaks
- ❑ Install Drain Line & Traps As Required
- ❑ Insulate All Piping As Required
- ❑ Install Condensate Pan Under Piping As Required

Ductwork Connections

- ❑ Install Ductwork, Fittings & Grilles As Required
- ❑ Proper Supply & Return Grille Type & Size Used
- ❑ Control Outside Air For Freeze Protection
- ❑ Insulate All Ductwork As Required

Electrical Connections

- ❑ Refer To Unit Wiring Diagram
- ❑ Connect Incoming Power Service or Services
- ❑ All Field Wiring In Code Compliance

Unit Startup

- ❑ General Visual Unit & System Inspection
- ❑ Record Electrical Supply Voltage
- ❑ Record Ambient Temperature
- ❑ Check All Wiring For Secure Connections
- ❑ Close All Unit Isolation Valves
- ❑ Flush Water Systems
- ❑ Fill Systems With Water/Refrigerant
- ❑ Vent Water Systems As Required
- ❑ All Ductwork & Grilles In Place
- ❑ All Unit Panels & Filters In Place
- ❑ Start Fans, Etc.
- ❑ Check For Overload Condition Of All Units
- ❑ Check All Ductwork & Units For Air Leaks
- ❑ Balance Air Systems As Required
- ❑ Record All Final Settings For Future Use
- ❑ Check Piping & Ductwork For Vibration
- ❑ Check All Dampers For Proper Operation
- ❑ Verify Proper Cooling Operation
- ❑ Verify Proper Heating Operation
- ❑ Reinstall All Covers & Access Panels

Blower / Motor

- ❑ Check Sheave Set Screw Tightness
- ❑ Check / Adjust Sheave Alignment
- ❑ Check Blower Wheel Set Screw Tightness
- ❑ Check / Adjust Belt Tension
- ❑ Adjust Blower Speed as Necessary for Balancing Airflow

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